

# Nano Entry System for CubeSat-Class Payloads

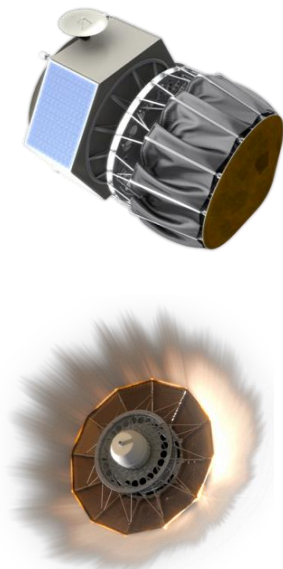
## Technology Need

Vehicles re-entering Earth's atmosphere or entering the atmosphere of another planet require protection from the heat of atmospheric friction.

## Description

The Nano Entry System for CubeSat-Class Payloads led to the development of the Nano-Adaptable Deployable Entry and Placement Technology ("Nano-ADEPT"). Nano-ADEPT is a mechanically deployed entry, descent, and landing (EDL) system that stows during launch and cruise (like an umbrella) and serves as both heat shield and primary structure during EDL. It is especially designed for small spacecraft where volume is a limiting constraint.

**Figure 1** 6 m diameter ADEPT-Venus in cruise (top) and entry (bottom) configurations



## Infusion

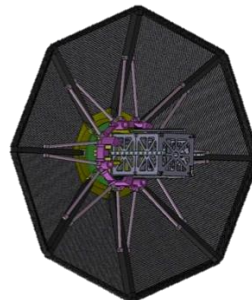
The Center Innovation Fund (CIF) provided the seed money for the initial technology, which subsequently received funding from the Game-Changing Development (GCD) programs. This funding allowed two test articles based on the technology to be tested in a wind tunnel.



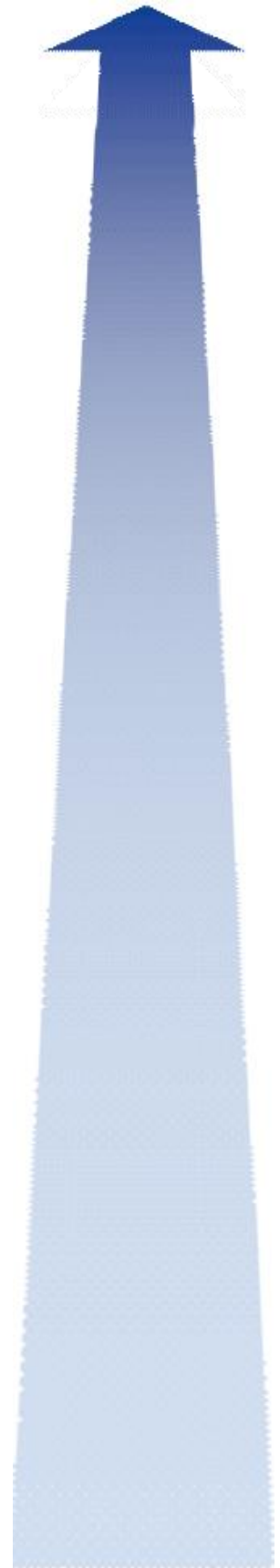
**Figure 2** Nano-ADEPT Solid Test Article

## Solution

The technology functioned well enough during testing that computational models of Nano-ADEPT will be refined.



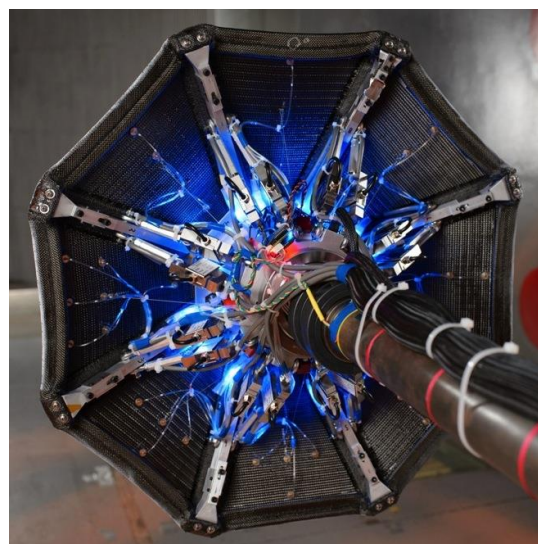
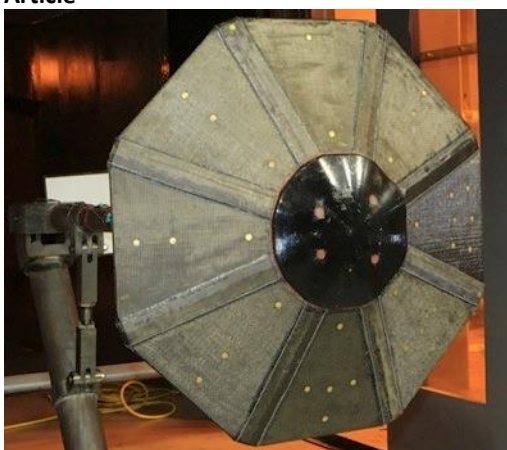
**Figure 3** 0.7 m diameter Nano-ADEPT shown with notional 2U chassis payload



## Benefit

ADEPT provides a mechanically deployable, low ballistic coefficient aeroshell system to enable missions not feasible with current systems. ADEPT offers 10x reduction in peak heating and deceleration loads suitable for science missions to Venus, Mars and other destinations. In short, ADEPT will enable robotic exploration to new planetary destinations and science that will revolutionize our understanding of the solar system.

**Figure 4 Close-up of Nano-ADEPT Solid Test Article**



**Figure 5 Fabric model rear view mounted on sting**

## Development Team Leads

Brandon Smith is the principal investigator for the Nano-ADEPT Center Innovation Fund award and led this wind tunnel test. He graduated with a B.S. and M.S. in Aerospace Engineering from Georgia Tech.

Dr. Ethiraj Venkatapathy is the principal technologist for ADEPT. He is the Chief Technologist of the Entry Systems and Technology Division at NASA Ames.



**Figure 6 Aeroloads Wind Tunnel Test Team**

<b>Lead NASA Center:</b>	Ames Research Center
<b>Funding Organization:</b>	STMD
<b>Location:</b>	California
<b>Year of Infusion:</b>	2015
<b>Timeframe:</b>	2014-15

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